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DEVELOPMENT OBJECTIVE

AN ADVANCED TILT TOP LIGHT TABLE

1. INTRODUCTION.

These development objectives describe the requirements to be met in the designing of an Advanced Tilt Top Light Table. This table is intended as a replacement for contemporary tables which tend to be awkward and uncomfortable to use. They provide inadequate light and, in most instances, require the operator to adjust to the limitations of the table rather than adjusting the table to the operator.

2. CONCEPT.

This table is intended to provide ease of viewing, increased illumination, easy loading and a superior film transport system. It is to be as light, compact and simple in mechanical design as is possible within the parameters imposed by the specific requirements stated in these objectives.

3. GENERAL DESCRIPTION.

This table shall provide a 11" by 18" illuminated area for use in viewing single rolls of 9½", 5" or 70mm film, or dual rolls of either 5" or 70mm film, concurrently. The light table in tilted configuration will normally be positioned facing the operator on the front or forward edge of a low, fixed or elevating table. The viewing surface will normally be tilted about the center of the shorter axis of the light box; however, the table may be used in a horizontal position or tilted about the long axis of the table.

4. REQUIREMENTS.

4.1. Illumination System

4.1.1. Intensity.

4.1.1.1. Range. The illumination system must provide at least 1500 foot lamberts, (measured at the illumination surface) with 1800 foot lamberts a definite design goal. This illumination shall not vary by more than VARIATION 10% between any two points within the entire illuminated surface area.

4.1.1.2. Variability. The illumination intensity shall be continuously variable throughout a range of from 15% to 100% of full intensity without evidence of "flicker."

4.1.2. Heat. The light table must be able to be operated continuously at maximum intensity over a 24 hour period in a room with an 80°F ambient temperature, without exceeding 110° on any external surface.

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Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

4.1.3. Diffuser. An opal glass or similar diffuser shall be located between the glass top and the light source.

4.1.4. Shades. Adjustable shades must be provided to block out all of the illuminated surface not actually covered by the film. Each of these shades must be located beneath the surface glass, mounted along the long dimension of the unit and extendable across the short dimension. This extensibility must be continuously variable between a minimum extension of (0) zero inches and a maximum extension of 9 inches. These shades must not encroach upon the illuminated viewing area when retracted and, in addition, must be lockable in any extended or retracted position.

4.2. External Configuration.

4.2.1. Size. The entire unit shall not exceed 32" in length and 16" in width. Width is exclusive of crank handles. The overall height of the table shall not exceed 9" when in the horizontal position. This is the height excluding the film spools.

4.2.2. Weight. The unit must be as light as possible commensurate with that weight which is necessary to maintain good stability and to balance the table in any of its tilted positions.

4.3. Spool Loading and Holding Mechanism.

4.3.1. Loading Mechanism. A loading mechanism must be provided for the fast loading and unloading of single spools of 9½", 5" and 70mm film or dual rolls of either 5" or 70mm. These rolls will range up to and including 500 feet in capacity. The loading system must be both quick and easy to operate and at the same time positive in action; i.e. it must not drop the heaviest full spool (9½", 500 ft.) no matter what the degree of tilt of the table or how fast or hard the film is cranked. A drop-in film loading device is one possibility.

4.3.2. Holding Mechanism. The holding mechanism which engages and secures the spool must be designed for easy one hand operation so that the film can be held in one hand while the holding mechanism is activated with the other. A positive but quick release lock must be provided on this securing device.

4.4. Film Transport.

4.4.1. General. The film transport system must be unique in that it shall permit bi-directional film motion controllable from either end, i.e., it will permit both winding and unwinding with the same crank at one end of the table. This transport system may be either mechanical or electro-mechanical; however, basic simplicity of design and complete reliability are mandatory; consequently a purely mechanical system is more desirable.

4.4.2. Film Capacity. The film transport system must be able to accommodate either single rolls of 9½", 5" or 70mm wide film on either partially or fully loaded spools of up to and including 500 feet capacity. In addition, provision must be made for handling dual rolls of either 5" or 70mm film simultaneously. These rolls should be mounted side by side with a supporting post in between.

4.4.3. Film Direction. Film spools shall be located at the ends of the long dimension of the viewing area, with the film or films transported along and parallel to the long axis of the light table. When dual rolls are used, the film strips will travel parallel to each other and to the long axis of the table, with a minimum of separation between strips.

4.4.4. Rollers. Rollers must be designed so that film can be transported with either emulsion up or emulsion down without scratching either the emulsion or the base of the film. The rollers must be either segmented

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

or some alternative system provided so that when dual rolls of film are used, alternate rolls of film can be wound in opposite directions concurrently or one of the dual rolls translated while the other roll remains stationary.

4.4.5. Film Tension. The film transport mechanism must maintain a light, constant, even tension on the film or films -- just enough tension to keep the film flat and in contact with the plate glass surface when the film is not being transported. This tension should be automatically reduced (eased) when the film is transported.

4.4.6. Film Drive. The film drive must provide a means of winding and unwinding single rolls of $9\frac{1}{2}$", 5" or 70mm wide film or dual rolls of either 5" or 70mm film. The drive must provide the ability to wind one of the dual rolls while unwinding the alternate roll or, for instance, permit one film roll to remain stationary while the other roll is translated. The drive control may be a hand crank or electric switch; however, if an electric control is used, it must permit the same degree of control sensitivity as a hand crank. If an electric drive is proposed, an additional high or "slew" speed must be provided. If a mechanical system is proposed, a two speed mechanical gear shift or electrical slew with a mechanical hand crank override will be required. In all cases, reliability of operation is mandatory. Each individual hand crank must provide very smooth winding and unwinding of film from either its own spool or the spool at the other end (long axis) of the table. The drive must be a low friction system incorporating inertia damping and antibacklash control. The efficiency, reliability, and ease of operation of this drive system is the most important single consideration in these development objectives.

4.5. Tilt Mechanism.

4.5.1. Amount and Direction of Tilt. The tilt mechanism must permit the table to tilt about its center from the horizontal to a position of 15° measured from the vertical when rotated about the short axis. This tilt, because of the 9" overall height requirement (when in horizontal mode), may require a movable pivot point and assumes that the base is located at the edge of the table to permit the film spools and transport mechanism to extend out into space and clear the supporting surface. In addition, the light table should be able to tilt about its center, from the horizontal to 45° from the vertical when rotated about its long axis. These motions must be smooth, positive and continuously variable. Ball joints, while providing the required flexibility of motion, have not proved successful in the past.

4.5.2. Tilt Lock Mechanism. A positive mechanism must be provided to lock the light table in all possible tilted and horizontal positions. This lock must be activated and deactivated with only a minimum of force and it must not lose its positive locking characteristics because of wear under continuous hard usage.

4.5.3. Electrical Wiring. All electrical wiring between the base and the light table must be carried internally or positioned where it can not be twisted or broken off. This wiring shall not interfere in any manner with the tilting motion of the table.

4.5.4. Balance. The table must be completely stable and remain properly balanced throughout all the possible tilt positions, even with dual 500 foot rolls of 5" film on one end and empty spools on the other.

4.6. Miscellaneous.

4.6.1. Construction. Construction shall meet the highest commercial standards.

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

4.6.2. Shock Hazard. The unit must be grounded and be free of all shock hazard.

4.6.3. Warning Light. A warning light must be provided to show when the unit is on even if the table light intensity is turned completely down.

4.6.4. Controls. All necessary controls must be provided in locations readily accessible to the operator regardless of the degree of table tilt. Human engineering factors must be thoroughly considered in the design and placement of all necessary controls.

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

27 March 1964

DEVELOPMENT OBJECTIVES :

ADVANCED FILM-VIEWING LIGHT TABLE WITH TRANSLATING MICROSCOPE CARRIAGE AND HIGH-INTENSITY TRACKING LIGHT SOURCES

1. INTRODUCTION.

These development objectives describe requirements to be met in the design and development of an advanced film-viewing light table with a translating microscope and integral, high-intensity, tracking light sources.

2. CONCEPT.

The proposed light table will improve viewing with translating stereo-microscopes or microstereoscopes. It incorporates features for ease of viewing and two high-intensity condenser-type light sources for the optimized narrow field illumination required for 30X-150X magnification viewing. These light sources shall incorporate an advanced tracking system to permit them to retain proper alignment with the microscope as the operator scans the film.

3. GENERAL DESCRIPTION.

This table shall provide an 11" by 40" illuminated area for use in viewing single rolls of 9½", 5" or 70mm film, or two rolls of either 5" or 70mm film. This unit will normally be positioned on an elevating or low, fixed table with the unit's viewing surface in a horizontal position, the long dimension extending to the right and left of the operator. The operator will work at the table as he would sit (or stand) at his own desk. Most operators prefer to position a viewer close to the edge of their side of the supporting table. A movable carriage shall afford translation of a microscope over the viewing area, while dual, independently adjustable, condenser-type light sources track the moving microscope.

4. REQUIREMENTS.

4.1. Illumination Systems.

4.1.1. General Illumination. To facilitate general viewing and small image location, the total 11" by 40" glass format shall be illuminated by fluorescent-type illumination.

4.1.1.1. Intensity Range. At full intensity, the general illumination system must provide at least 1000 foot-lamberts measured at the illumination surface. Illumination shall not vary by more than 10% between any two points on the entire illuminated surface.

4.1.1.2. Variability of Intensity. The intensity of illumination shall be continuously variable through a range of 15% - 100% of full intensity without visible evidence of "flicker".

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

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4.1.1.3. Heat. The general illumination source must be able to be operated continuously at maximum intensity over a 24-hour period, in a room with an 80°F ambient temperature, without exceeding 110°F on any external surface of the light table.

4.1.1.4. Diffuser. An opal glass or similar diffuser shall be located between the light source and the clear glass top.

4.1.1.5. Shades. Adjustable shades must be provided to mask out all of the viewing surface not actually covered by film. Each of these shades must be located beneath the surface glass, mounted along the long dimension of the unit and extendable across the short dimension. This extensibility must be continuously variable between a minimum extension of (0) zero inches and a maximum extension of 9 inches. These shades must not encroach upon the illuminated viewing area when retracted and, in addition, must be able to be locked in any extended or retracted position.

4.1.2. High-Intensity Illumination System.

4.1.2.1. General. Two high-intensity, condenser-type light sources shall be provided. They should be positioned between the general illumination light source and the surface glass plate.

4.1.2.2. Independent Adjustment. Each of the light sources shall be independently adjustable in the X and Y axes in such a manner that they can be positioned (1) beneath the separate objectives and/or rhomboids of a microstereoscope or (2) beneath the single objective of a stereomicroscope. These two condensers must be capable of a minimum separation between them of 50mm, from center to center: 40 mm is a design goal.

4.1.2.3. Independent Adjustment Control. Controls must be provided for regulating the independent adjustments. These may be mechanical (hand wheels), electrical or electro-mechanical devices. If electrical or electro-mechanical, they must provide the same degree of control sensitivity as hand wheels or knobs.

4.1.2.4. Common Tracking Motion. Once the initial, independent adjustment to align the condensers with the objective lenses or rhomboids has been made, the light sources shall be locked in common synchronized motion. Thus, when the microscope and microscope carriage are translated, the two high-intensity sources will track the carriage while retaining their previous alignment with the microscope's objective (or objectives). These condensers must track throughout the total scan range of the microscope.

4.1.2.5. Intensity Range. At full intensity, the high-intensity sources must provide adequate illumination of a film area with an average density of 2 units as viewed through the optical system of a [redacted] stereoscopic microscope (with rhomboids), operating at a magnification of 100X. All other magnification settings of this and the other two instruments (paragraph 4.5.3.) shall be equally well-illuminated. These sources shall operate at a color temperature between 3500° - 5500°K.

4.1.2.6. Variability of Intensity. Means shall be provided for continuously varying illumination from 50% - 100% of full intensity on each independent high-intensity source. Such reduction shall not reduce Kelvin temperature below 3500°K. On and off switches must be provided for each high-intensity source.

4.1.2.7. Heat. Temperature of the film (average density of two units) shall not exceed 100°F above ambient after being stationary for 30 minutes in the high-intensity light path under maximum illumination. The temperature of the light table's outside skin (including the top glass plate) shall not exceed 50°F above ambient when continuously operated for an eight-hour period, with film (2.0 density) on the table and with both condenser and general illumination operating at maximum intensity.

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

4.2. External Configuration. 55x21x7

4.2.1. Size. The entire unit shall not exceed 55" in length and 21" in width. Width is exclusive of the crank handles but includes all the components of the translating carriage. The overall height of the light table shall not exceed 7" (minus the carriage, scope and reels.) The carriage height shall be kept at a minimum.

4.2.2. Weight. The unit must be as light as possible without sacrificing good stability.

4.2.3. Height adjustment. A superior adjustment system must be provided so that the entire table can be raised or lowered 3".

4.2.4. Tilt Mechanism. A means must be provided for a 0° through 15° back-to-front tilt of the light table about its long axis. This motion must be simple, smooth, positive and must be able to be locked at any angular tilt within this range.

4.2.5. Comfortable Viewing Position. The light table, the translating carriage and the microscope adapter mounts must be designed to place each of the microscopes at a comfortable viewing height and in a comfortable working position. Human engineering factors should count strongly in the new design. It is understood, of course, that these positions also depend on the height of the illuminated surface, the requirement for the carriage to adequately clear the film and the varying working distances of the microscopes.

4.3. Spool Loading and Holding Mechanism.

4.3.1. Loading Mechanism. A means for the fast loading and unloading of single spools of 9½", 5" and 70mm film or two rolls of either 5" or 70mm must be provided. Rolls will range up to, and including, 500-feet capacity. This loading system must operate quickly and at the same time be positive in action: i.e., it must not drop the heaviest full spool (9½", 500 feet) no matter how fast or hard the film is cranked. A drop-in film loading system is desirable.

4.3.2. Holding Mechanism. The holding mechanism which engages and secures the spool must be designed for easy one-hand operation -- so that the film can be held in one hand while the holding mechanism is activated with the other. A positive but quick release lock must be incorporated.

4.4. Film Transport.

4.4.1. General. A unique film transport system shall permit bi-directional film motion controllable from either end: i.e., it will permit both winding and unwinding with the same crank at one end of the table. This transport system may be either mechanical or electro-mechanical; however, basic simplicity of design and complete reliability are mandatory. Consequently, a purely mechanical system is more desirable.

4.4.2. Film Capacity. The film transport system must accommodate either single rolls of 9½"-, 5"- or 70mm-wide film on either partially- or fully-loaded spools of up to, and including, 500-feet capacity. In addition, provision must be made for handling two rolls of either 5" or 70mm film simultaneously. These rolls should be mounted side by side with a supporting post in between.

4.4.3. Film Direction. Film spools shall be located at both ends of the long dimension of the viewing area, with the film or films transported along (and parallel to) the long axis of the light table. When two rolls are used, the film strips will travel parallel to each other and to the long axis of the table, with a minimum separation between strips.

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

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4.4.4. Rollers. Rollers must be designed so that film can be transported either emulsion-up or emulsion-down without scratching. Either the rollers must be segmented or some alternative system provided so that when two rolls of film are used, the alternate rolls can be wound in opposite directions concurrently or one of the two rolls translated while the other roll remains stationary.

4.4.5. Film Tension. The film transport mechanism must maintain a light, constant, even tension on the film or films -- just enough to keep the film flat and in contact with the plate glass surface when the film is stationary. This tension should be automatically reduced or eased when the film is moved.

4.4.6. Film Drive.

4.4.6.1. Drive Modes. The film drive must: wind and unwind single rolls of 9½"-, 5"- or 70mm-wide film or two rolls of either 5" or 70mm film; be capable of winding one of the dual rolls while unwinding the alternate roll and/or permit one roll to remain stationary while the other roll is translated.

4.4.6.2. Drive Control. The drive control may be a hand-crank or electrical switch; however, if an electrical control is used, it must provide the same degree of control sensitivity as a hand-crank.

4.4.6.3. Dual Speed Range. A dual speed range with a high or "slew" speed shall be provided. This could be in the form of a two-speed, mechanical gear shift, a two-speed electrical motor, a variable lever arm crank or an electro-mechanical approach.

4.4.6.4. Reliability and Efficiency. Whatever the system, it must be very reliable. Each individual hand crank must wind or unwind film very smoothly -- from either its own spool or the spool at the other end of the table. The drive must be a low-friction system which incorporates inertia damping and antibacklash features. The efficiency, reliability and ease of operation of this drive system is one of the most important considerations in this development.

4.5. Translating Microscope Carriage.

4.5.1. General. A carriage shall be provided for translating a stereomicroscope or microstereoscope in both X and Y directions over the illuminated format.

4.5.2. Amount of Translation. The optical center of the microscope shall scan an area of 10" by 35". This area shall be centered in the illuminated area, across the short dimension, and shall commence one-half inch from the right-hand edge of the illuminated area. (The right-hand edge refers to the operator's right as he faces the light table.)

STATINTL

4.5.3. Adapters must be provided for mounting three separate microscopes:

STATINTL [redacted] stereoscopic microscope,

STATINTL [redacted] They must permit a rapid but stable mounting of any of the above units (with their attendant focusing mechanisms) upon the translating carriage. In addition, this mounting must permit an 180° rotation of each scope so that it may be used parallel to either the X- or Y-axis of the light table and from either long side.

4.5.3.1. Carriage Motion. The carriage motion must be a smooth, positive, low-friction motion which is free of vibration ("chatter"). The friction load must be consistent throughout its range: i.e., a consistent pressure results in a consistent motion with no position of lesser or greater resistance.

Approved For Release 2001/05/11 : CIA-RDP78B04747A001400030002-2

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4.5.3.2. Locks. Positive locks must be provided to lock the carriage in X and Y at any position of its 10" by 36" travel.

4.5.3.3. Fine Micrometer Motion. A fine micrometer X- and Y-microscope motion must be provided. The total travel of this motion must be ±2cm. in both X and Y. This motion shall be a precision, auxiliary motion accomplished once the main translational carriages have been locked in position. This precision motion must be graduated and easily readable. The motion shall be accurate to .001mm plus .01% of the total distance being measured with a least count of .0005mm.

4.5.3.4. Rigidity. It is mandatory that the carriage ways be of rigid construction to insure perpendicularity of the X and Y axes. These ways (or tracks) must be perpendicular and parallel to the extent that, when one end of the Y track is locked (so that it can not move in X) and a pressure of 5 pounds is applied to the other end (longest possible lever arm) of the Y track, it will not deflect more than .002".

4.6. Miscellaneous.

4.6.1. Construction. Construction shall meet the highest commercial standards.

4.6.2. Shock Hazard. The unit must be grounded and free of all shock hazards.

4.6.3. Warning Light. A warning light must be provided to show when the unit is on even if the (table) light intensity is turned completely down.

4.6.4. Controls. All operational controls must be conveniently located and readily accessible to the operator. Human engineering factors must be thoroughly considered in the design and placement of these controls.

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